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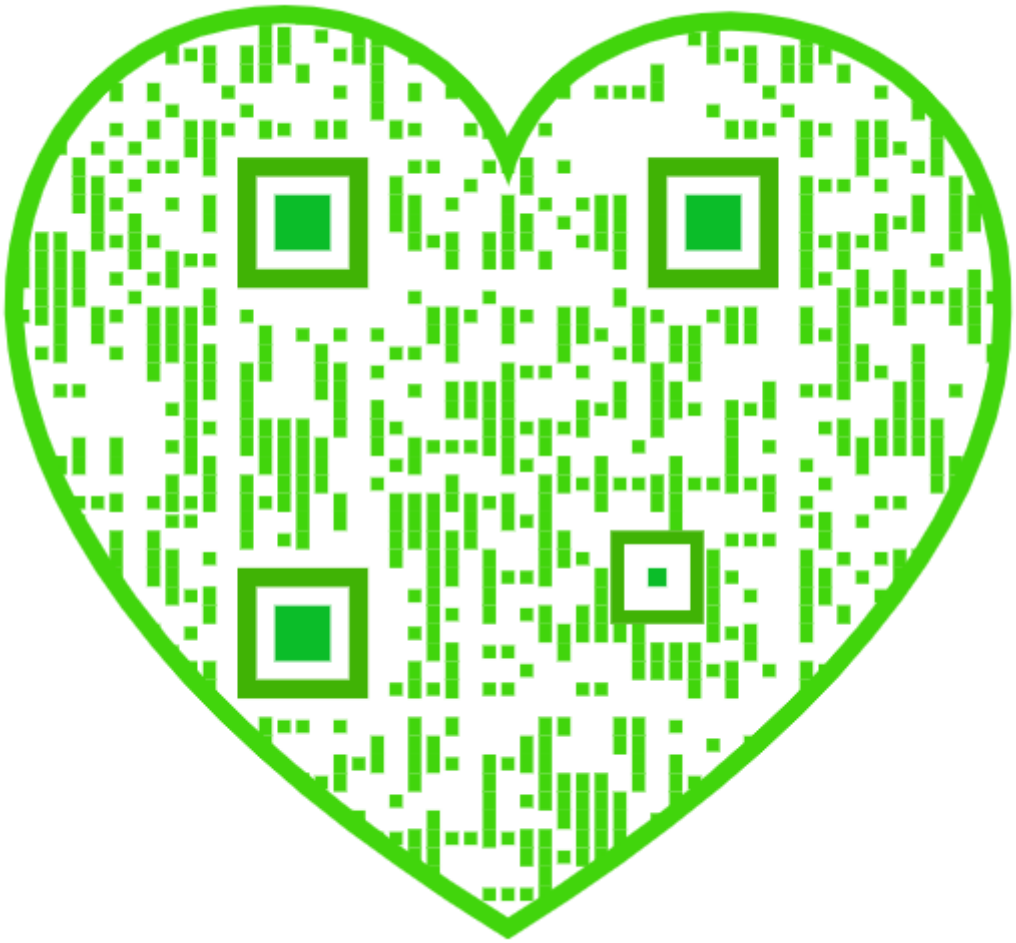
HORIZONTAL PLOWING

AND

HILL-SIDE DITCHING.

BY NICHOLAS T. SORSBY, M.D.,
OF ALABAMA.

Mobile:
S. H. GOETZEL & CO.
1860.



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Book

SMITHSONIAN DEPOSIT

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AND

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BY NICHOLAS T. SORSBY, M.D.,

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PREFACE.

This Essay was published in pamphlet form, and in the TRANSACTIONS OF THE NORTH CAROLINA STATE AGRICULTURAL SOCIETY, and in the NORTH CAROLINA PLANTER, in 1858; and in the SOUTHERN PLANTER, Va., and in the AMERICAN COTTON PLANTER AND SOIL OF THE SOUTH, in 1859.

In order to correct the errors of those issues, and extend its usefulness further, the author has consented to publish a cheap edition of it. It has been pronounced the "best Essay ever written on the subject," but as we are all liable to err, the author will be thankful to have any error or ambiguity of language pointed out to him, so that in a future edition they may be corrected or explained.

THE PUBLISHERS.

AN ESSAY

ON

Horizontal Plowing and Hill-Side Ditching

By NICHOLAS T. SORSBY, M.D.

OF ALABAMA.*

DEDICATION.

This unpretending production is respectfully dedicated to the Farmers and Planters of the State of North Carolina, as a testimony of his tender regard for them, and love for his native State, by

THE AUTHOR.

FORKLAND, GREEN COUNTY, ALABAMA,
October, 1857.

TO THE COMMITTEE ON ESSAYS:

Gentlemen: You perceive from the length of this Essay, that it has cost me a good deal of *time* and *labor* to write it. Rest assured, I would not have written such an Essay for any other than the Agricultural Society of North Carolina.

I was induced to write it from the interest I feel for the progress of the Society, and the advancement of the Agriculture of the State, and as the only and best way I am able to assist them.

If awarded the Premium, the Society is at liberty to publish all, or any part of it, and as many copies as they desire, but I beg leave to reserve the copyright; and as I have no copy of it, I would be under many obligations to them to return it, when it has served them in the manner they desire.

By so doing they will much oblige,

Very respectfully,
Their ob't serv'nt,
N. T. SORSBY.

FORKLAND, Ala., Oct. 13th, 1857.

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* A Premium of $50 was awarded by the Society to this Essay.

PREFACE.

This Essay was written in compliance with the demands of the North Carolina State Agricultural Society.

The writer having felt the need of such information, in days past, feels he would be uncharitable and ungrateful to withhold, and not impart his knowledge on the subject, to his brother farmers.

He has endeavored to serve them in a feeble manner, in a matter deeply concerning their pecuniary welfare, and tried to arrange the subject in a systematic form, and explain the different methods of the horizontal culture, so that the humblest mind can understand and appreciate them.

Each article is separate and distinct from the others, and yet are connected together by the general bearing of the subject.

Should this small effort in behalf of the soil of North Carolina, meet with the approbation and requisitions of the members of the Agricultural Society, and receive the careful perusal, study, and application of its principles to the soil, by the farmers and planters of the State, the writer shall feel that his labor is not lost, and his talent not buried in oblivion.

INTRODUCTION.

It has been but a few years since the subject of this Essay was brought to the notice of the American Farmer.

It now occupies an important and prominent position among the scientific operations of the Southern Farm.

It may be considered as a new branch of agricultural science, founded upon correct and well established principles of the sciences of Engineering and Hydraulics ; and essential to the welfare of the farmer, to the preservation of the soil, and to good husbandry.

Forced, almost by necessity, and the strong sense of self-interest and foresight, a few intelligent minds have been brought to discover the urgent need of reforming the old destructive

system of plowing in straight rows up and down hills, and of substituting the better mode of horizontal culture.

The absurdity of the old method is really a subject of astonishment and mortification to those who practice the new methods. The arable lands of the South have been nearly exhausted by it and a careless and wasteful culture.

The beauty and simplicity of the principles and practice, as well as the advantages of the new methods, can only be realized and brought home to the farmer and planter, by observation, study, and practice, and when once understood, they will wonder at their past folly of land-killing, and grieve to know they practiced it so long, when a different and better system is so easily learned and pursued.

When we reflect upon the disasters to the soil, occasioned by the pursuit of the old method, and see the apparent apathy to, and indifference with which the more perfect and better system is viewed by some intelligent farmers and planters, at the present enlightened era and golden age of agricultural science, we feel alarmed for them, for their lands, and the succeeding generations.

What a poor inheritance to hand down to an industrious son, an old dilapidated homestead, with an old worn-out, galled and gullied farm ! Think of it, farmers and planters !

The very sight of decay all around, excites in the mind of the young man, disgust, despair, a disposition to abandon the old place, once so dear to him, and the family, now so much abused, and seek a newer and better place, richer land, among strangers. He has no desire to cultivate the worn-out old fields, and perhaps there is no new land to clear. The old method of plowing up and down hill, has much to answer for ; it has driven many a young man to the South-west, and perhaps, eventually, to prison, or the gallows, who might have been a useful citizen, could he have remained at home, and made a living.

Whilst the *horizontal culture* and the *ridge* and *furrow system* are attracting the attention, and being adopted by intelligent planters and farmers, its principles must be studied scientifically and practically, and new discoveries in the art applied, tested, and settled in the minds of men, or else there will be no end to the diversity of opinions that may arise, and lead to discussions that may retard the advancement of the new science.

It would require much time and space to elucidate the different methods of the horizontal culture, as fully as some men may desire, perhaps.

We have endeavored to simplify it, and should some of our readers not comprehend it perfectly, all that we can say to them is, study the principles laid down here, and then take the *level* and follow the plumb, and it will lead them over more tortuous

and obscure lines than we have penned here, and a few horizontal rows run with patience and care, will teach them more about it than was ever dreamed of in our philosophy.

Our aim has been, in writing this Essay, to collect together our ideas on this subject, to compare them with others, and deduce from them correct principles, and upon these principles establish with fidelity, practical rules, and thus accomplish by a general survey of the subject, and a brief enumeration of the details founded upon our own experience and observation, all that we think the State Agricultural Society of North Carolina, requires of the writer.

HISTORY OF HORIZONTAL CULTURE.

We regret to state that we have not been able by a careful research of all the Agricultural works that we have been able to examine, in the English and French languages, to find the origin of this system of culture.

Mr. Thomas Jefferson, who was a close observer of improvements in Agriculture, in a letter dated "Monticello, 6th March, 1816," says, "My son-in-law, Colonel Thomas M. Randolph, is, perhaps, the best farmer in the State; and by the introduction of the Horizontal method of Plowing, instead of straight furrows, has really saved this hilly country. It was running off in the valleys with every rain, but by this process we scarcely lose an ounce of soil.

"A rafter level traces a horizontal line around the curve of the hill or valley, at distances of thirty or forty yards, which is followed by the plow; and by these guide-lines the plowman finishes the interval by his eyes, throwing the earth into beds of six feet wide, with large water furrows between them. When more rain falls than can be instantly absorbed, the horizontal furrows retain the surplus until it is all soaked up, scarcely a drop ever reaching the valley below.

"Mr. Randolph has contrived also, for our steepest hill-sides, a simple plan which throws the furrows always down hill. It is made with two wings welded to the same bar, with their planes at a right angle to each other. The point and the heel of the bar are formed into pivots, and the bar becomes an axis, by turning which, either wing may be laid on the ground, and the other then standing vertically, acts as a mould-board. The right angle between them, however, is filled with a sloping piece of wood, leaving only a cutting margin of each wing naked, and aiding in the office of raising the sod gradually, while the declivity of the hill facilitates its falling over. The change of the position of the share at the end of each furrow is effected in a moment by withdrawing and replacing a pin."

It seems Colonel Randolph introduced this method of plowing into Virginia, previous to 1816, as Mr. Jefferson states he was acquainted with it two or three years previous to writing this letter.

This is the earliest notice that we have seen of the use of the horizontal culture, as practiced in the South at the present day. It would be gratifying to know from whence he introduced it, and where it originated.

In "Taylor's Arator," published in Virginia the beginning of this century, on the subject of plowing hilly lands, it is stated "that such lands will admit of narrow ridges, as well as level, by a degree of skill and attention so easily attainable, that it has existed in Scotland above a century past under a state of agriculture otherwise execrable, and among the ignorant Highlanders! It is effected by carrying the ridges horizontally in such inflections as the hilliness of the ground may require, curved or zigzag, preserving the breadth. The preservation of the soil is hardly more valuable than that of the rain water in the successive reservoirs thus produced to refresh the thirsty hill-sides, instead of its reaching to and poisoning the valleys."

It is very strange, if this system was pursued in Scotland so very long ago, that there is no mention made of it in English works.

During an extensive tour, and residence of over three years in Europe, from Great Britain to Naples, Italy, through Holland, Belgium, France, Switzerland, and parts of Germany, we never saw, heard or read of its being pursued in any of those countries as it is done here, and we cannot conceive how it could have ever been practiced in Scotland and not kept up now-a-days.

In our travels throughout the United States, we have seen it pursued from Mississippi to North Carolina. We have been to Monticello several times, when a student at the University of Virginia, and though remarking the productiveness of the soil there, and around Charlottsville, we were too young to notice the mode of culture, but we are sure we never saw a rafter-level or any other level applied to land in Virginia. Had we seen it we should have noticed it, because we had followed it before we went there to school, in 1836.

In "Thaër's Principles of Agriculture," a standard German work, in speaking of plowing ridges, he says: "The most advantageous disposition of them that can be made on an inclined surface, is to give them a horizontal or standing direction;" but he says nothing more on the subject. Had he been acquainted with the method as pursued in the South, he would have written considerably on it.

We are inclined to believe the Horizontal system of plowing is of Southern invention. We are astonished at the fact, since the Southern planters and farmers have the reputation of being such careless and wasteful cultivators of the soil.

We consider it the most important discovery of the modern agricultural era. So important is it to the South, and to the

soil in every part of the world where it rains like it does here, that the discoverer of the method deserves the lasting gratitude of the Southern people, and a place upon the tablet of memory next to that of the father of our country.

Hill-side ditching and guard-drains, were discovered subsequent to the origin or introduction of the horizontal system into Virginia. They were first introduced into that State soon after the introduction of the horizontal method, about 1815 or 1816; by whom, we do not know.

The first written notice of the horizontal culture and hill-side ditching that we ever saw, was in the pages of the "Southern Cultivator." Major E. D. W., our step-father, first introduced the method of Horizontal Plowing on the level system into this county, in the spring of 1834. He had read a notice of it in some paper, which induced him to try it on some hilly land at the DIAL PLACE.

He used the rafter-level and plummet-line, and ran off rows to be plowed four feet apart into beds for corn and cotton. We were a boy then, and carried the hoe and made the chop marks for him. He was so well pleased with the results of it, and with his experiment, that he has continued it ever since with great success on two plantations. He has a thousand or more acres under the plumb. He has tested it thoroughly, and has preserved the fertility, retained the soil, and improved his lands, aided by a proper application of manures, under a severe course of cropping. Without this system, all the manure he could make would not preserve half of the land in its present state of fertility for five years. He would as soon abandon planting as to abandon the horizontal system of culture.

We have assisted him in the work a good deal, and induced him to try guard-drains and hill-side ditches about 1851 or 1852, in order to lighten his labor and lessen his care and attention to it, as he is getting old and the confinement to the field and exposure to the cold during the winter and spring, are injurious to his health. But, he says, he could dispense with the drains and ditches if he could attend to the plowing in person every spring, and direct the work and correct the errors of the previous year's work.

An old negro horizontaler lays off the rows, and attends to one plantation where there are between six and seven hundred acres under the plumb; and manages it astonishingly well for a man of his understanding.

His lands were originally of a good quality, and are of a mixed character. On one plantation, the grey and mulatto sandy land prevails, the subsoil being yellow and red clay a foot, and eighteen inches originally, in parts of it, beneath the surface soil.—The balance of the land is a chocolate loam on a red clay subsoil.

Some of it is considered stiff red clay land. On the other plantation, the chocolate loam prevails with a close, stiff red clay subsoil, requiring a long and sharp pointed plow to penetrate it when moderately dry. The rest of the land on this plantation, is grey and gravelly sandy soil, loose and porous. Most of the land on both places, is gently undulating ridges. Some of it hilly, and some knolls. The stiff red clay land is the most difficult and expensive to cultivate, and is the best land for grain. It is also the most difficult of his land to manage on the level method of culture.

I took my first lessons under him in the science, and owe him a debt of gratitude which can never be paid. He taught me the level culture, and I taught him the grading method. I commenced planting in 1844, in Hinds county, Mississippi, near Jackson, in copartnership with a brother. The *level culture* No. 1, and the *grading method* No. 1, both combined, without drains and hill-side ditches, had been in use a few years on that plantation. The soil, a close, tenacious, marly clay, of a yellow color, changing into an ashy colored soil, when thoroughly disintegrated and cultivated a year or two. I was partial to the level culture, and he to the grading method. I found out after a better acquaintance with the land, that the level culture retained the water too long, and made the land too wet for cotton. The grading method drained, but washed the land a good deal. After testing both methods to my satisfaction, I gave into his views rather from an avaricious motive than otherwise, to make better crops, though at a sacrifice of some land that took the streams and disappeared. From one to three inches fall were given to each row, when practicable, and the short inside rows plowed on a level. The land was rolling, and drains between the ridges conveyed the water into ditches and branches. We continued both systems until I left in December, 1850, and moved back to this place. The grading method has been kept up by him. I commenced a mixed system here in 1851, and have practiced both of them to a certain extent.

My land is chocolate and grey sandy land on a red and yellow clay subsoil. The grey land is of a fine texture, and much of it runs together and bakes. The chocolate land is loose and porous. It is generally a little undulating, some rolling, and some flat basins and ponds. It requires much ditching and surface drainage, and some under-draining. Forest growth, pine, oak, hickory, chestnut and poplar, with a variety of undergrowth.

My experience and observation teaches me, that the *level culture* is the best method ever discovered to prevent arable land, of the majority of soils in the South, from washing by rains, but not the best always to secure good crops. The grading method is the safest as a general rule for the culture of cotton, and can

be pursued to great advantage on many soils that could be cultivated well on the level method, when one is willing to lose a little soil to make a better crop, by draining the land. No one system of culture is, then, applicable to all soils; and on large plantations of mixed soils, both the level and grading systems should be applied. He is a fortunate man who understands the different methods well enough to apply them to the best advantage to the different soils, on a large plantation. It requires close application to field study, a good knowledge of the geology of the soil and the agricultural character of the land, with years of experience, to know how to cultivate land to the best advantage to the soil, and to the increased size of the purse.

SECTION I.

DEFINITION OF HORIZONTAL CULTURE.

Horizontalizing, Circling, and Leveling land are different terms employed by *Agriculturists*, in the *South*, to mean the same thing; viz.: cultivating land in parallel lines run by a leveling instrument to direct and control rain water with the plow.

SECTION II.

ITS OBJECTS.

The objects of the System of horizontal culture are, to irrigate, to drain, and to preserve arable soil, in the simplest and most economical manner.

1st. By collecting, maintaining, and distributing rain water, on the surface of arable land, it effects natural irrigation.

2d. By conveying it away, by artificial channels, it effects drainage.

3d. By a proper system of irrigation and drainage, the soil and the food of plants are retained, and the fertility of the land is preserved.

SECTION III.

GENERAL CONSIDERATIONS.

Rain water being a solvent of the food of plants, and the medium of supplying them with many of their elements, the system of horizontal culture teaches us to control, and diffuse it in

the soil, and distribute it in such a manner that the food of plants it contains, may be made available to the utmost degree, in promoting their growth ; and, when it exists in excess, to remove it without injuring, or washing away the soil.

Hence, we conclude that a correct system of manuring and improving land, depends greatly upon a proper regulation of water by the horizontal culture.

We perceive, then, that the horizontal culture is a beautiful branch of the science of Agriculture ; that it is a mixed art, a combination of irrigation, drainage, and manuring. We cannot, therefore, study it well, appreciate it properly, and practice it successfully, without some knowledge of agricultural engineering, of the geology of the soil, and hydraulics, and the application of them to irrigation and drainage.

We can then realize and appreciate the several advantages and connections of these branches of science with each other, in developing the chemical and physical properties of soils, and in the improvement of the fertility of land. To practice it scientifically, and successfully, we must study and understand the geological formation, and the agricultural character of the soil, and ascertain by observation and experiment what plants grow on it best, and are most profitable to cultivate.

Drill-husbandry, that is, the cultivation of crops in drills, by the ridge and furrow method, is indispensable, and the check and hill-culture are inadmissible except on level lands, as a general rule, by the system of horizontal culture. Of course, the broadcast method can be employed, as well with one method as with the other. The horizontal culture, by the ridge and furrow method, conflicts with the practice and opinions of many farmers, in the oldest of the Southern States, who advocate the check and hill culture ; but an acquaintance with the horizontal culture changes their practice and opinions.

SECTION IV.

THE DIFFERENT METHODS OF HORIZONTALIZING LAND

Are divided into two principal systems : viz :

1st. The level Method of Culture.

2d. The Grading Method of Culture.

The Level Method, (or Irrigating System,) is divided into two methods ; viz :

1st. Horizontaling with an instrument, on the level culture, without the aid of guard-drains, and hill-side ditches ; and,

2d. The level culture, aided by those drains and ditches.

The Grading Method, or Draining System, is divided into four different systems, viz :

1st. Horizontaling with an instrument, giving a grade to the rows, without the assistance of guard-drains, and hill-side ditches.

2d. With a grade to the rows, the same as that given to the drains and ditches, accompanied by those drains and ditches.

3d. With a grade given to the rows so as to empty their water into the drains and ditches.

4th. The straight-row method. The rows run up and down hills, and empty into hill-side ditches.

Besides the above methods, there is the old mode of horizontaling with the eye, without the aid of an instrument, or guard-drains, or hill-side ditches.

SECTION V.

THE DIFFERENT METHODS EXPLAINED.

The old method of hill-side plowing by running the rows around hill-sides with the plow, directed with the eye, is mere guess work, and only an approximation to accuracy, and of course is very imperfect.

It is done with the object of retaining the rain water in some instances, and of removing it in others ; in either case, it cannot effect the object in as perfect a manner as the new methods of level and grade work done on correct principles, by the leveling instrument.

When the object is to retain the rain water, it answers tolerably well in some countries, on porous, poor, sandy soils, where the showers are not frequent and are light, and where the luguminous crops are cultivated mostly on high beds and lands, as a substitute for artificial irrigation, and where the spade and hoe are used, generally, for the purpose of forming the ridges.

When adopted to drain hill-sides by the plow, unless the soil it not disposed to wash, it is very liable to do more injury to the land by washing it away than benefit by removing the water.

It should not by any means be resorted to now, since we can substitute better methods for it. It is the first step towards the horizontal culture from the straight-row method ; and was perhaps invented for the purpose of retaining instead of removing water.

1. *Level Culture or Irrigating System.*—By this method the rows are laid off with a leveling instrument on a perfect level, and the land cultivated without the aid of guard-drains, or hill-side ditches.

Here, science steps in to correct the imperfections of the eye. It is impossible to lay off a level row by the eye. The most skillful horizontaler cannot judge with accuracy the degree of inclination of lands, and discover all the inequalities of surface well enough to horizontal land on a level by the eye. But, with a *rafter-level* properly made and adjusted, it can be done, on an even or uneven surface with perfect accuracy, on a dead level; and if the land be properly plowed the rows will hold all the water that falls on them.

It is the best and only system ever invented to prevent comparatively level, and gently undulating lands, from washing.

It is intended to retain all the water that falls on land just where it falls: this is natural irrigation. We all know the value of water for the nourishment of animals and plants. They cannot live without it. Crops often fail for the want of it. By this method none is wasted. Enough water is absorbed during winter and spring rains by land cultivated on this system, to almost make some crops, especially when aided by light summer showers, that would fail to do so, cultivated by the grading method. This method is most applicable to all poor, thirsty, porous sandy soils, whether they rest on clay or sandy subsoils; and to many varieties of clay soils not too compact and retentive of water.

We think we may say with truth, that we never knew, in this country, but one kind of clay soil, on uplands, that this system was not applicable to, on the ground of making it too wet for profitable culture. That is the fine, close, tenacious, marly-clay soil, resting on a retentive yellow clay subsoil, of the black-jack, post-oak, and hickory ridges of Hinds, Madison, Yazoo, Carrol, Holmes, Warren, and other parts of Mississippi.

Besides this kind of soil to which the level culture is objectionable, are the compact red and yellow clay soils of some hilly lands, and the blue and white clays of low-lands.

The red and yellow clay lands may be cultivated by it, if they admit of subsoiling to advantage. It is seldom that the level culture is objectionable for corn and small grains, and the root crops. But when it causes the soil to become too wet during the cultivation of crops, to plow well, and hastens a rapid growth of grass and weeds that destroy the crops, it is an evidence that it should be abandoned, and a grading method substituted for it.

2. *Level Culture with Guard-drains, or Hill-side Ditches.*—The rows are plowed on a level, and guard-drains, or hill-side ditches are added, with a slight grade to correct the evil of the excess of water, and remove it, should the ridges break. Some soils, such as close tenacious clays, though plowed deep, may absorb a great deal of water during heavy and repeated rains, until the plowed soil becomes well saturated; the water will then sink until it reaches the impervious strata, not broken by the plow,

and move along that strata on steep hill-sides, until it accumulates in such quantities as to break the ridges, and flow downhill, carrying the soil with it.

Again, in clay soils, plowed shallow, a heavy rain succeeding another heavy rain, that had run the land together, and baked by the sun, and closed its pores, may cause the water to accumulate in level rows until the volume and weight of water makes a breach, and some of the ridges give way, and the water is precipitated from row to row till it reaches an outlet.

A mole, a stump, bad plowing, the wheels of a cart or wagon, and other causes may break the ridges, and cause the land to wash. To prevent such a disaster, guard-drains and hill-side ditches have been invented, to aid and protect the level culture, and to correct the ignorance and errors of the inexperienced horizontaler, and save his time, labor, and soil. But, in many instances, they encourage careless work, and are sometimes evils to the system. They should not be relied upon too much; the remedy is sometimes worse than the disease.

1. *The Grading Method. (or Draining System.)*—The great object of this method is surface drainage, of arable land: hence it is divided into,

1st. Horizontaling with a grade given to the rows, without the aid of guard-drains and hill-side ditches.

Every row is designed to drain itself, and of course the other drains are unnecessary. It is a kind of self-sustaining system, and a substitute for straight rows. It is beautiful in theory, but difficult to practice in a general system, on all soils. Some fields, and parts of fields, no grade is necessary, whilst different grades are required according to the inclination of land, and the physical properties of soils, and the length of rows. The length of rows is very irregular by this method, and short rows emptying into long ones, pouring their water into them, force them to wash into gullies. Hence, it is impossible to prevent the soil from washing by this method. It should be confined to close clay soils. This method, combined with level culture, answers a better purpose.

2d. *Horizontaling with a grade given to the rows* the same as that of guard-drains and hill-side ditches. This method was adopted, doubtless, to correct the evils of the preceding method.

When the drains are well made, they check the flow of water descending down the hills from the broken rows, and thus convey it away and protect the land beneath them. Without their aid much mischief might take place, but if the work by the preceding method be well done, there is no need of the drains to aid it. Imperfect work, then, excuses their employment. But they are indispensable evils to the system they are used to protect, and are much employed.

3. *Horizontaling with a grade given to the rows* so as to empty their water into guard-drains and hill-side ditches.

This is truly a draining process, employed on clay-up-lands, and low-lands, and answers a good purpose when the rows are not too long, and the fall is correct. Of course the drains and ditches require considerable fall, and to be very capacious. It is popular with those planters who have clay soils, and trust much to overseers, and negroes, and kind Providence for gentle showers, to make them crops. But overseers make mistakes, plowmen do bad work, and the clouds pour down heavy rains, and the soil, as it were, melts and runs rapidly away. To answer a good purpose, the overseers, plowmen, and drains require strict attention, or the land will be injured by this method.

4. *The Straight row Method, with Hill-side Ditches.*—The ditches in this instance are cut on hill-sides with considerable fall, and the land is plowed on the old straight-row method, the plowman raising his plow over the ditch banks as he passes them. It is evidently a troublesome business to raise the plow over the ditches, and keep them clean. If the soil be sandy, and disposed to wash, the ditches must be deep and large, the fall great, and the plowman careful, which is contrary to negro character, or else every heavy rain will fill up the ditches with sand, break their banks, and cut the land into gullies and galls. However, it has the recommendation of being simple, and better than the old up and down hill method, without the protection of ditches.

Experience will soon teach any one that it is a bad system for hilly lands; for low-lands it answers a good purpose for quick and effectual drainage, and enables some low-lands to be cultivated that could not be without this kind of drainage.

On the rich low wet lands, and the rolling up-lands, in the prairie or lime lands of Alabama and Mississippi, when too wet, this kind of expeditious drainage is the *sine qua non*,—the proper method to remove the water, and dry the land in time to prepare it for a crop, and to save the cotton from damage by excess of water.

SECTION VI.

PHILOSOPHY OF THE LEVEL METHOD.

It is true there are deep, sandy, alluvial soils that absorb all the water that falls on them during the heaviest rains; but again, there are other soils when cultivated on the straight-row method, that are injured by the irregular distribution of water, one part of the field being drained too much, whilst the land below it is being drowned; thereby, both parts sustaining an injury.

The crops on such land grow and mature irregularly in consequence of the irregular distribution of the water and the culture. The level culture corrects these evils. It retains the water and soil in its proper place, and when the land is cultivated alike, all remains nearer the condition of dryness, and the crops grow off more uniformly on the same quality of land and mature nearer the same time.

Should the land be manured, the elements of the manure remain where deposited, and not removed by the first rain to the nearest ditch or branch. It irrigates and preserves the soil, when properly done. It is the best method to employ to aid in restoring exhausted lands.

It is very difficult to lay down any set of rules by which to do the work; because, the physical properties of soils are such, and the inequalities of land vary so much, no one rule or set of rules would apply to any great extent of surface. One part of a field might require the level culture, and another part the grading method. Hence, we are forced to adopt the one or the other, according to circumstances, and to do the work correctly, we must be acquainted with all the different methods.

It matters but little, where the work begins or terminates in the field, so the rows are laid off accurately, on a level. The most important rule is to follow the level. let it lead to whatever point it may. It will run at every point of the compass, and form rows of every imaginable form and length, terminating any where in the field. It will lead the new beginner in the art, into a maze from which he can scarcely extricate himself, but he should have patience and perseverance, and all will come out right and no land be lost. He must be content to follow the level, but not try and make it follow him, and force it to any particular place or termination. The only way to terminate a row at a certain point, is to start the level at that point; but ten chances to one, in returning, if the next row does not go off at an angle, and terminate at some distance from the first starting point. It is immaterial whether the rows be long, short, straight or crooked, or where they begin and terminate, so they are on a level, and the land be well plowed in rows or ridges. This should ever be borne in mind. The horizontaler will make mistakes, and be awkward at first, but will learn to do the work correctly.

SECTION VII.

ADVANTAGES OF THE LEVEL METHOD.

This system is the best mode of cultivating land ever invented to prevent the devastating effects of rain water washing away the soil and the manures put upon it. It enables the soil to ab-

sorb more water, and retain it better, and give it back to plants when needed, more effectually and regularly than any other mode, thus preventing the deleterious effects of drought. It makes the soil more uniform in production; improves its fertility by retaining the manures; makes it easier to work, with less labor; causes the crops to grow faster, more uniform in growing and maturing; and as the rain water is evenly distributed on all parts of the field alike, when one part can be plowed, all can be done at the same time, and saves time turning around at wet land.

DISADVANTAGES OF THE LEVEL METHOD.

It seems in the order of things in this world, there is always an evil attached to almost every good. So it is in this instance, but we shall find that the disadvantages disappear by practice, and are counterbalanced by the advantages.

The disadvantages are, the unavoidable necessity of having so many short rows terminating at any part of the field, forcing the plowman to turn around often, and lose time by so doing: (this time, however, is made up in the greater number of long rows.) The injury to the crop, done by the plow, the mule and the hand in turning around at the end of the short rows. The difficulty at first of doing the work well, and of plowing the rows out without breaking up the work, and deranging the rows. The constant care and attention, by the overseer or employer, to maintain and keep up the system. The necessity of using the ridge and furrow system and abandoning the check and hill culture.

SECTION VIII.

PHILOSOPHY OF THE GRADING METHOD.

Surface drainage is one of the most important operations connected with the tillage of the Southern soil. The value of the grading method cannot be over-estimated. It has to contend with a troublesome element, that is a moveable element, always seeking its level, whose particles have a great affinity for each other, and running together whenever they can, thus accumulating in a mass, and increasing its volume and velocity when in motion. This element we wish to control with a level and the plow on the surface of arable land, and derive all the advantages of it we can as a feeder of plants, and at the same time, get rid of the excess that would prove injurious to the soil and growing plants. Nature does this for us in some soils and teaches us how to do it in others. It sinks the water in porous soils, and stores it up for future use of plants, and removes it when super-

abundant, from undulating close clay soils before it does injury to the plants that do not require it, teaching us to level porous thirsty soils, and deepen and drain compact close soils. We should study carefully the operations of nature, and apply its beautiful principles to the present subject, and conform them to the limited capacity of the uneducated minds of men. Very few fields of one hundred acres have the same inclination of surface, and one variety and depth of soil. Land slopes in every direction, and each hill-side or plane of inclination requires sometimes a different mode of drainage and a different method of culture.

In examining a field, we may find some acres requiring the level culture, others again, one method of grading, and another a different method, and so on perhaps, through the whole list of the different methods of grading. It would be improper, then, to employ one system alone for every part of the field. The different methods should be applied according to the demands of the land. Science should guide us, and the one-system horizontaler is led into error by his efforts to apply it to all localities and inclinations of surface of land. We should be acquainted with all the systems, and not make a hobby of any one. Better try first one and then another, in experimenting, and select those that are best and most applicable to the land. If we find a straight row more convenient and better than a crooked one, if it be correct, adopt it, without sticking to the idea that the horizontal culture consists of a system of crooked rows. Experience will soon teach the new beginner the degree of grade necessary to give to his rows and drains, and the number of drains or ditches to use, to drain a certain area of land. The grade to the rows and drains is governed by the kind of soil, the declivity of the land, the extent of the surface to be drained, and the method of horizontaling they are intended to aid. If the level culture, with drains, be adopted, a few shallow guard-drains with a fall of from one to two inches for every span of the level, may answer in moderately close clay soils, and less fall in porous sandy soils. If the grading method be adopted, the fall of the rows and the drains depends upon the kind of method of plowing used, and the nature of the soil cultivated. We should recollect, that the washing power of water descending a hill recently plowed, is dependent upon the declivity and the length of the hill, the depth of the plowing, the character of the soil, and the quantity of water in motion. Hence, the greater the fall, the longer the hill, the shallower the plowing, the more porous and light the soil, and the greater the volume of water, the more the land will be washed. If the grade be not sufficient and the dimensions great enough, the rows are apt to be chocked and broken. A regular and proper grade must be given, and if an error be com-

mitted, it should be on the side of too little fall. If the grade be too much the rows will wash into gullies. Guard-drains and hill-side ditches should have grade and capacity enough to drain the land speedily and effectually, without having their sides and bottoms washed too much. With a proper fall and dimensions, they may be used to convey sand to fill up gullies, basins, and deposit it convenient to cover galled places.

SECTION IX.

ADVANTAGES OF THE GRADING METHOD.

It possesses all the advantages of surface drainage of arable soils in a simple and the best possible manner without doing serious damage to the land. It is the best method ever invented to assist in breaking up galls and gullies, and filling up depressions in the land, and the beds of old ditches and branches, as well as ponds, basins and bogs, and in aiding the plow and the hoe in restoring worn-out soils.

It possesses, also, many of the advantages of the level culture.

DISADVANTAGES OF THE METHOD.

By careless construction of drains, and neglecting to attend to them afterwards, they are liable to choke and break, and wash the land below them into gullies. When they have too much fall, each row or drain is apt to wash into a gully, and do harm to land below their mouths by covering it with sand. They distribute water irregularly, and where not demanded, drying the ridges and hills too much, and drowning the bottoms. Upon the whole, they are of minor importance compared to the benefits of drainage.

SECTION X.

SUBSOIL PLOWING

Means loosening the subsoil with a plow without any mould-board to turn it up.

We have seen, Nature teaches us three important operations that are essential to the perfection of the horizontal culture, viz: to open, to deepen and to drain the soil.

An open, deep and dry soil, we all know, can be cultivated to better advantage and profit, by either the level culture, or grading method, than a close, shallow and wet soil by any method. The latter requires much labor and time to open, deepen and

drain it, and if a good soil the labor pays, if a bad soil the labor is often lost.

Under the soil of some stiff red clay lands, long cultivated, originally good, there frequently exists a strata of compact clay and sand, called a hard-pan, formed by the treading of the stock and sole of the plow, cemented together by oxide of iron, clay and fine sand. It exists, sometimes, in gravelly soils, but less frequent. Wherever it prevails it makes the land hard to cultivate, and it produces sorry crops. It is always on extremes of wetness or dryness. Such land is difficult to horizontalize, without the aid of subsoil plowing.

Again, the plow forms in clay land, on the subsoil, small gutters or channels, into which the water sinks, accumulates, flows and washes the soil, obstructs the work of the horizontaler by breaking the ridges and undermining the banks of drains and ditches when they are not made deep enough on hill sides to extend below these channels.

The subsoil plow aids very much the horizontal culture by breaking up the hard pan, the gutters or underground water furrows, galls and gullies, on clay lands; it opens, deepens, pulverizes the subsoil, drains the surface soil by sinking the water, and extending the area of air, manures, and the roots of plants, and thus producing a decided amelioration of the soil and subsoil.

The best time to do the work is winter and spring, when the land is moist and soft, and when time can be taken to do it well. The most effectual plan is to open a furrow with a two-horse plow, with a good turning mould-board, and follow in the same furrow with the two-horse subsoil plow, as deep as both plows can be drawn. If the time cannot be spared to run so many subsoil furrows, half the number will answer a good purpose. An expeditious plan for corn land is to open the water furrow between the ridges, with a scooter plow, deep, and follow it with the subsoil plow; put in the manure, and bed out with scooters and shovels, finishing with a turning plow to make a good water furrow.

When employed in lands for small grain the subsoil plow can be run to advantage in the old water furrow, which is the centre of the land when plowed out, and also in the new water furrow left open. We need not fear subsoiling clay and gravelly soils when hard and compact, especially when old and much worn.

SECTION XI.

TRENCH PLOWING.

This differs from subsoiling, by raising up the subsoil, and mixing it with the surface soil, with a turning plow following in the furrow of another turning plow. It brings up the subsoil,

disintegrates the hard-pan and distributes them through the surface soil. It is of great assistance to the horizontal culture, by breaking up the gullies, galls and hard-pan, and thus lays the foundation of the process of restoring the fertility of worn-out lands.

If the soil was of a good quality originally, and the subsoil of the same quality, trench plowing is of much advantage to the land to deepen and mix the two. But if the land be poor, and the subsoil poor red clay, the trenching should be done by a scooter plow, following in the furrow of the turning plow with the view of breaking up the subsoil, and pulverizing it, without mixing them too much. Mixing a poor clay with a poor soil is bad policy, unless much manure is added to improve it. Subsoiling and trench-plowing are often confounded with each other, but are quite different operations.

SECTION XII.

LAND-GALLS.

These are abrasions of the soil, by rain water removing the soil of clay lands long cultivated by the old wash-away method, and leaving the clay exposed. They might be very properly called land-sores, of a virulent character, and hard to heal. The best way to treat them, is to scarify them deep every spring, sow them down in peas, plow them in the fall, and sow in rye; repeat the same operation next year, cover them with all the leaves, stalks, long manure of any kind, and the third year a tolerable crop of corn or cotton may be grown on them. To manage them to the best advantage, they should be surrounded, or cut off to themselves, by guard-drains, or hill-side ditches.

SECTION XIII.

GULLIES.

These are open water-channels, caused by rain water and careless up and down hill plowing. They are hideous objects to the eye of a scientific and practical farmer, and should receive the condemnation of all good husbandmen.

There are many ways of filling them up, but in doing so, sometimes two are made in place of one, unless it be properly done and aided by the horizontal culture. The land requires to be well graded and the direction of the water changed, and not be permitted to flow so abundantly down the gullies as before.

When they are less than three feet deep, they may be stopped and filled up in two or three years, in this way. Every twenty steps drive up stobs or oak boards across and in the gulley, close together, to catch and hold the dirt and water in part; then, throw in leaves, tussucks of grass, corn and cotton stalks, pine straw, pine tops, with the laps up hill, and plow up and down on each side of it, and drag in as much dirt as possible with hoes. Sow them in peas and rye, and let grass grow in them. Plow horizontally across, keeping the same regular grade in passing them; to do so, the rows will make a curve up and down.

Large gullies will require more labor and time to fill them up. Cut a ditch across them at proper distances apart, and pile logs on each other in the ditch, until the top log reaches above the banks of the gully. Now gather all the rubbish, stumps, stones, logs, leaves, pine saplings, with the laps up hill, into the gulley, and draw in all the dirt convenient and pack it against the logs, and on the pine tops, so as to make a dam. The drains and hill-side ditches can be emptied into them, and supply dirt to fill them up. Allow grass, weeds, peas, and small grain to grow in them. In a few years they will be filled up, and bear some crop every year to hide them from the gaze of a neat farmer.

SECTION XIV.

GUARD-DRAINS AND HILL-SIDE DITCHES.

Guard-drains are shallow, open water channels, made with the plow and hoe, on arable land, laid off with a leveling instrument, with a regular and gentle grade, directed around undulating ridges and hill-sides, for the purpose of receiving and conveying away superfluous rain water.

Hill-side ditches are a variety of guard, or catch-water ditches, but intended to operate more effectually than they, by having a greater capacity and grade, in order to remove a greater volume of water in a shorter time from hilly lands. They are a part of the system of horizontal culture, and are used to aid and protect it, and correct its defects. We may very properly term them the safety-valves of that system, when properly constructed, and waste-ways when improperly constructed.

They are valuable adjuncts to the horizontal culture, and especially to the grading methods, when made according to correct principles of hydraulics. On loose, sandy lands, they should be dispensed with whenever it can be done with safety, and as few as possible be used, and they as far apart from each other, and as short as the nature of the land will admit of, to effect the

desired object. Clay lands, that have been plowed up and down hill, in straight rows for years, and a good deal abraded and washed into gullies, require the drains and ditches to be well made. It takes two or three years sometimes to break up the old water furrows and gullies, and change the course of the water, unless deep plowing be combined with the grading method. Guard-drains usually answer the purpose on gently undulating lands.

Hill-side ditches are best on hilly lands. Inexperienced horizontalers would do well in commencing the horizontal culture, to employ drains to protect their imperfect work. They should be made as short as possible, avoiding all abrupt curves or sudden bends, and directed around ridges or hills from a medium point, dividing the water and discharging it on both sides of the ridge or hill into a ditch, gulley, branch, or outside of the field, where no damage to adjoining lands may be done. The fall should be gradual and uniform, and just sufficient to discharge the water without washing their sides and bottoms.

The size of drains and ditches should be determined by reference to a variety of circumstances, the combined influence of which may generally be estimated in practice, although not reducible to any very exact rules, viz: 1st, we must consider the annual quantity of rain; 2d, the quantity which falls on the land during a heavy rain; 3d, the nature of the soil as to porosity or compactness; 4th, the inclination of land; 5th, the length of slopes and extent of surface to be drained. Every horizontaler must take into consideration these things, and judge for himself.

A general and important rule as to the capacity of drains is, that they should exceed rather than be deficient in the dimensions ordinarily required to discharge the quantity of water for which provision is to be made. A good rule by which the depth of drains may be estimated, can be derived from a knowledge of the character of the soil and its action upon water. Thus: a light, deep, porous, sandy soil, will absorb water as fast as it falls, if it lies level; if undulating, it will absorb it not so fast, and the deeper and more porous the soil and subsoil, the more and faster it will absorb. On the contrary, a shallow, sandy soil on a clay subsoil and clay lands, will absorb less water, more slowly, and more of it will pass off. It will follow the underground plow furrows when absorbed, and the drains should extend below those furrows to catch the water. The close clay soils, and the stiff lime lands absorb water slowly, and if they be deep, the drains should extend below the soil, and nearer together than in porous soils.

The kind of drains to be used, their depth, and distance apart, can be ascertained by experiment alone. It is safest for the new

beginner to follow the example of those who have tested them on similar soil to his, and where found to answer well.

The following scale of the depths and distances of drains and ditches, may give an idea of what they require, according to the classification of soils into compact, medium, and porous, each of which variety may be subdivided into several degrees of porosity and retentiveness :

CHARACTER OF SOILS.			DRAINS.			
NOT SUBSOILED.	DEPTH OF SOILS.		DEPTH OF DRAINS.		KIND OF DRAINS.	DISTANCE APART.
POROUS	Feet.	Inches.	Feet.	Inches.		According to the Declivity of Land.
Light loam, (fresh land,) Sandy " " "	1	00	0	10	Guard-Drains.	Wide apart.
Light gravelly Sand, Coarse gravelly Sand,	0	10	1	00	Guard-Drains.	Wide apart.
MEDIUM.						
Clayey Loam	0	8	1	00	Guard-Drains.	Not so wide apart.
Gravelly Loam, Friable Loam,	0	10	0	10	Guard-Drains.	Not so wide apart.
COMPACT.						Need Subsoiling.
Tenacious Clay,	0	6	1	00	Hill-Side Ditches.	Close together.
Friable Clay,	0	8	1	00	" " "	" "
Soft Free Clay,	0	10	1	00	" " "	Not so close.

If the land be subsoiled, the drains must be deepened, and made wider apart. The tenacious clays are not very commonly cultivated in the South. They are too wet for cotton.

SECTION XV.

DRILL HUSBANDRY

By the ridge and furrow system, in contradistinction to the check and hill method, is indispensable to the horizontal culture. Ridging and bedding up land is so familiar to every plowman in the South, little need be said relative to the manner in which it should be done. They are made both by shallow and deep plowing. We prefer shallow plowing and flat beds, in new ground, stubble or sward land, and in porous light sandy, and loose gravelly soils. Deep plowing is best in old hard upland clay soils, that need deepening and opening, in bald prairie lands, and in low wet lands of both kinds.

The height of ridges and lands are dependent upon the kind of culture, the crop grown, and the character of the soil.

For potatoes, we desire them high when the plants are set, and when the crop is laid by.

For corn, we prefer them flat in dry uplands, higher in lowlands, with clean water furrows.

For cotton, in fresh land, and porous alluvial, and light sandy lands, moderately flat beds may answer very well. They are regulated by the width of the beds. In clay lands, the cotton beds should be high and narrow, and the water furrows deep and clean. We prefer not to plant cotton in wet land, but if it be done, high beds well drained, is the only remedy against the disastrous effects of water. The cotton beds are made close or wide, according to the quality and productiveness of the land. In rich river bottoms, and black cane brake lands, they vary from five to eight feet wide. Thin and medium quality, upland, sandy and prairie lands, they vary from three to four feet in width; some poor lands, they are as near as two and a half feet apart.

We cultivate our land in ridges for corn, cotton, peas and potatoes; they vary in height and distance according to the quality, and dryness of the soil. They are from six to fourteen inches high, and from three to four feet wide apart, that is, from crown to crown. When desiring to sow small grain in lands, we sow the grain, and plow four or five ridges into a land, and preserve the direction of the rows.

We sometimes sow cotton land in oats and rye, and throw four turning plow furrows on the grain, and plow out the stalks with a large two horse shovel, thereby making a flat bed, drained by the water furrow, and preserving the width of the beds.

We sometimes sow rye in the fall in cotton land, and run two sweep furrows in each row. In very porous land, if the rye be sown just before cattle are turned in the field, no sweep furrow need be run.

SECTION XVI.

THE ADVANTAGES OF THE RIDGE AND FURROW SYSTEM

Are, that when the ridges or beds are well put up without too great an inclination, it facilitates drainage by breaking up the crust formed on the surface of land that is sometimes so close and tenacious as to prevent the water from sinking into the subsoil beneath the roots of plants; it exposes a greater surface and depth of land to the action of the sun and air; it enables land to be cultivated that cannot be cultivated on the hill and check method, or any other method; it renders land drier and less subject to the destructive effects of wet seasons; it makes land easier to work at all times, with less injury to the crops; the plowing of spring and summer are less hazardous and laborious; the tillage of spring and summer is more certain and effectual; the crops have a nice, mellow bed of loose, dry and warm earth to grow and expand in above the cold and wet subsoil; in fact, an arti-

ficial climate is produced, which improves the health, and hastens the growth of young and tender plants that demand such especial care during spring; and finally, it prevents land from washing away, and is the basis and support of the horizontal culture.

SECTION XVII.

THE CHECK AND HILL METHOD.

This method answers a good purpose on very loose, porous, level pine lands, for potatoes and ground peas, cultivated mostly with the hoe. It is objectionable to the horizontal culture because it upsets and breaks up the horizontal rows, and turns the water loose, on the land, and destroys the effect desired by the horizontal system.

SECTION XVIII.

PLOWING STRAIGHT ROWS BY STAKES.

This method has been pursued by farmers for ages, and is the favorite plan with the majority of them at this time.

The great ambition of the plowman who lays off the rows is to make them perfectly straight, regardless of hill or valley, across the field from fence to fence; nothing but a ditch stops him.

It is astonishing to see the accuracy with which it can be done by a few stakes set in a line with each other. Of course, the rows make beautiful drains to dry the hills, and cover up and drown the valleys with sand and water. The hill tops and sides are in a few years cut into gullies, and the soil precipitated into the valleys to impoverish them with sand and clay.

This is truly the wash-away land killing method, and should be abandoned by every farmer or planter who cultivates hilly lands. Level plains of sandy land can be plowed in this manner very well, without doing much injury to the soil, particularly if the rows are changed and crossed every year or two. We adopt straight rows whenever we can run them on a level.

SECTION XIX.

HORIZONTALING BY THE EYE.

Instead of running the rows up and down hill, in straight lines, this method directs them around the hills, and diagonally across them, with a considerable fall to them.

If they are directed diagonally across the fields, and desired to be straight, they are laid off by stakes. If intended to circle the hill, the horizontaler walks around the way he desires the rows to run, and the plowman follows him, and lays off a guide-row. The rows are then laid off by the guide-rows. This is guess work, and very inaccurate. We have seen a very intelligent planter, who was familiar with the horizontal culture, circle a basin badly gullied, on horseback, followed by two plowmen, one laying off after the other. The basin was surrounded by a guard-drain that kept the water from the adjoining land out of, and conducted it off out of the field. The plowmen and the horizontaler were below this drain. As they passed over the gullies, it was "gee Ben, haw Dick, haw Ben, gee Dick," sometimes in rapid succession, and was very amusing. We called this work a horizontal farce.

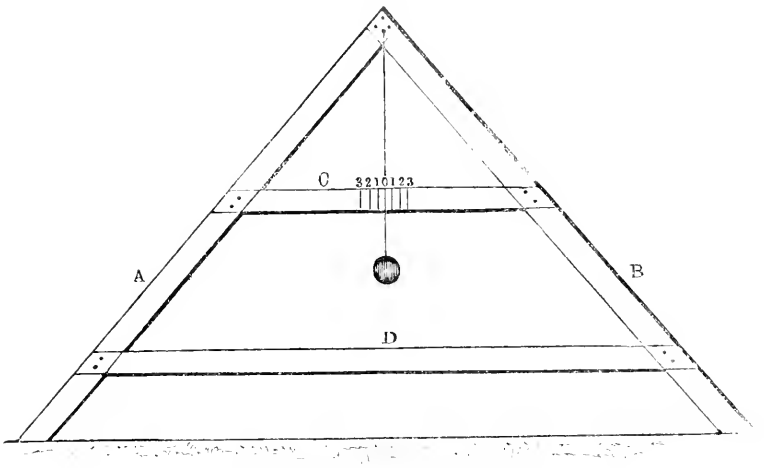
The rows were laid off like the track of a snake in the sand, and had they not been protected by the guard drain, they would have been cut into many troublesome gullies and galls.

SECTION XX.

THE SPAN OR RAFTER-LEVEL.

Of the many leveling instruments in use, among Horizontalers, the above is the best, because, it is the simplest, the easiest of application, and is most generally employed. Besides, any carpenter can make it.

In horizontaling land it is necessary to success, to keep a perfect level of the rows in the level culture, and a uniform fall of them, and the drains in the grading system. The most convenient and handy level is made with a span of 12 feet 4½ inches, and 6 feet high. This span is ¾ of a perch: So that we can readily calculate the length of the rows and the ditches, and estimate the rise or fall of them per perch.



THE SPAN OR RAFTER-LEVEL.

EXPLANATION OF THE FIGURE.—To construct this level, take two strips of dressed heart pine plank, well seasoned, A B, 3 inches wide, $\frac{3}{4}$ inches thick, and 12 feet 6 inches long. Another strip for a foot brace, $1\frac{1}{2}$ inches wide, $\frac{3}{4}$ inches thick, and 11 feet long, D.

Also, another for a middle brace, or graduated bar, 2 inches wide, $\frac{3}{4}$ inches thick, and 6 feet long, C. Lap one end of A and B together, let them into each other, and make them secure with wood screws, so that when fast, the other ends of the strips may be 12 feet, $4\frac{1}{2}$ inches apart from outside to outside, and the level, when finished, be 6 feet high.

Make the foot brace, D, fast to these two strips, one foot from the ground, when the level is standing on its feet.

Make the middle brace, C, fast to the same strips, three feet from the top, and saw off the ends of all, so that the level, when completed, will have the dimensions, and span the distance above mentioned. Paint it, and when dry graduate it thus, viz: Suspend a plumb line with an ounce lead from the centre of the top, and let the bob extend two inches below the middle brace.

With a spirit level find a perfect level on a plank, and stand the Rafter Level on it. Mark where the plumb line crosses the cross bar with a pencil, and the places occupied by the feet; change the feet, and put each in the place occupied by the other; mark again with a pencil where the plumb line crosses the bar; if it crosses exactly in the place it crossed before, that is the centre of the level, and the true line; if not, the exact distance half way between the two lines is the level line. To be very exact, the assistance of a spirit level will find it. The true line of

level being found, mark on the top of the bar 0, and make a plain line on the front side of the bar to correspond with 0. Now put a $\frac{1}{2}$ inch block under the left foot of the level, and mark where the line settles, and $\frac{1}{2}$ on the top of the bar; remove the $\frac{1}{2}$ inch block, and put a 1 inch block under that foot, and mark where the line crosses the bar, and 1 on top of the bar; proceed in that manner until it is graduated to 6 inches. Repeat the same process for the right foot, and other side of the line on the bar, and the level will be graduated ready for work.

SECTION XXI.

APPLICATION OF THE RAFTER LEVEL TO THE LEVEL CULTURE.

The manner of using the level is the same for both methods, with this difference: for the *Level Method* the rows are laid off, and plowed on a dead level, whilst for the *Grading Method*, a fall is given to the rows and drains.

It is necessary to be more accurate, and apply the level oftener for the level method, than for the grading method.

Before going to work, we must determine upon, first, the kind of crop to be cultivated; second, the character of the soil; third, the inclination of the land, whether comparatively level plains, undulating ridges or hills; and fourth, the method of horizontaling desired.

To illustrate and explain the different methods, we will select a forty-five acre field, which we call the Gin-house field. Upon examining it, we find a plain, a hill, a ridge, a basin, a pond, and the balance undulating irregular surfaces, and wet flats and ditches. The soil is a grey and dark sandy land, on a yellow and red clay subsoil, of medium quality, that has been much abused by bad plowing and constant cropping. It presents a sufficient variety of soil, and undulations of surface, necessary to explain our subject.

It was horizontalized by me in 1851.

SECTION XXII.

TO HORIZONTAL A PLAIN BY THE EYE ON THE STRAIGHT ROW METHOD.

We will go to the field, with the level well graduated, accompanied by a small boy, who carries a bundle of canes or sticks, some one foot, and some six feet long. A sensible plowman, with a quick,

tractable mule, with a scooter or rooter plow, and a hill-side mould-board plow follows.

To try the skill of the plowman, and the temper and spirit of the mule, we select a plain on which the Gin-house stands, for operation. We suppose the field to be a stubble-field, having been always plowed up and down hill. Having determined upon the direction of the rows, and the points of departure and termination for them, we direct the plowman how to proceed, order him to set his stakes, "be sure you are right, and then go ahead," and lay off four feet rows. As negroes' memories are short, and they are careless, and mules slow and stubborn, we wait to see him started. If he proves to be inefficient, and lays off crooked rows, irregular distances apart, and can do no better, we dismiss him, as not trusty and skillful, and procure another plowman, because much depends upon his skill for our work to succeed. Should he answer the purpose, we leave him and go hence to

SECTION XXIII.

CIRCLE THE ROUND BASIN.*

This basin has been partially drained by a ditch passing through it, and emptying into the main ditch, but never succeeded, because the ditch has never been deep enough, and the margins of the basin are too high to admit of deepening it enough without much labor.

We desire to circle it on a level, so that each row may hold its water, and keep it out of the ditch as much as possible.

We will commence at the ditch, at the east side of the basin, above the margin of the basin, where the land is comparatively level, and lay off a guide-row that may embrace all the sloping land inside of it.

We set the feet of the level on similar ground, and move the forefoot, that is to lead off, until the plummet line, or spirit bubble, indicates the true level. We stick down a long cane by the side of the plum for the guide stake. We then move the level and put the hindfoot by the side of the stake, and move the forefoot from side to side, until the true level is found; we move it again, and put the hindfoot exactly in the place the forefoot occupied, and find the level again; we stick a short cane down under the plumb; we move the level again, and proceed in the same manner, getting the level every time, and sticking a short cane down every third, and a long cane down every sixth span of the level, until we surround the basin, and return to the point, or near the place we started from, and we put down the guide stake there. The level may return to the ditch above or below

* See fig. 1, Basin.

the first guide stake. It makes no difference, so the line is run correctly, where it returns to the ditch.

We now lay down the level and walk around and examine the stakes. We will, perhaps, find them standing very irregularly, not in a perfect curved line, but a little zigzag. A skillful horizontaler can detect in a moment, by the eye, almost where the true line of level is, and can move the stakes and re-set them, so that the line will have a more regular curve; it being somewhere between the stakes, inside of some and outside of others. Having arranged the stakes to our fancy, we start at the guide stake, the plowman following, and we walk from stake to stake, the plow moving them as the mule throws them down, and the little boy picking them up, until we arrive at the last guide stake, which is likewise plowed up.

We have now laid off and plowed a circular row, not a perfect circle, and if there be no sudden curves in it, and if it suits our fancy, we let it stand; but if we have any doubt about its accuracy, we take the level and try it, and if necessary, mark the inaccurate places, and run them over with the plow.

We now move the plowman on the inside of this guide row, and commence four feet from that row and run a row by it, the plowman carrying a four-feet measuring rod, with which he occasionally measures the distance between them to see that he keeps the proper distance; and thus he keeps around until he returns to the guide stake. As the ditch is narrow and shallow he passes over it, takes another row, and goes around as before, on the basin side. We take the level and follow him, and test his row to see if it be correct, and if there be any variations of importance from a true level, we stop him and correct it. There are two or three ways of doing this. A very convenient way to keep the row going on around, is to widen the distance between the rows a little at one place, and narrow it at another. Or, if this cannot be done, we put in a short row beginning at the ditch and going around until the defect is corrected. We have then to start another row and lay off by that, which the plowman can do, and go around again. Sometimes it becomes necessary to widen or narrow two or three rows, or put in two or three short rows, before the defects are remedied.

In finishing the basin, the rows get shorter and shorter until we have to wind up with a few short straight rows run parallel with the ditch. This concludes the work inside. We now examine the first guide row and the land surrounding it, and if we see that it has not embraced all the sloping land, we run one or more rows on the outside of it, either entirely or partly around the basin, as the case demands. If the basin had no outlet by a ditch, we could commence to circle it, on either side, and go around and stop on returning to the guide stake, nearly opposite to it. We

then get on the inside of it, and run the rows by it, as above stated. It is seldom that a guide row on making a circle, returns and meets again. Sometimes when we start to circle a basin, we commence so far above the margin of the slope, that the level goes off into the field instead of around the basin; in that event we go lower down on the margin to commence, so that the row may go around the basin. But, if we find it necessary after trying the level method for this basin, to protect the rows by a guard-drain from the water around oozing into them, we can lay off a guard-drain around it, to catch the water and discharge it into the ditch.

If we find, upon experience, that the level culture is not applicable to the basin, we can try a grading method. This is sometimes the case.

The plowman beds up the land high, in this basin, in the same way that he beds up straight rows of the same distance apart, except that he plows around the basin, and does not stop to turn around at the ditch until he is obliged to do so from the nature of the rows.

SECTION XXIV.

HORIZONTAL A HILL ON THE LEVEL METHOD.—NO. 1.

We will now work on the *Peach tree Hill.** About an acre on the top of this hill is an uneven plain. The hill slopes North, East and South. There is a fence on the South and West, and a ditch on the North and East.

We can commence work almost any where, on the side or top of the hill. For convenience of plowing we will begin on the top, not far from the angle of the fences, and lay off a level row from fence to fence. This done in the same manner that we did for the basin, moving the level as there, and staking the row for a guide row. When done the plowman begins and plows it out. We test it and find it correct, and nearly straight. We put him to laying off four feet rows by it next to the fence. They become nearly straight before he finishes them. Whilst he is at work there, we step down thirty paces to the brow of the hill, and commence at the west fence and lay off another guide row, which makes a curve as it goes around to the South fence. We examine our stakes, re-set them, and the plowman plows it out. We test it with the level, and correct the errors with the plow.

* See Fig. 1. Peach Tree Hill.

The plowman, after finishing the first set of rows, has gone on the other side of his guide row, and is laying off by it. We watch and try his work with the level, and see that he keeps his distance. We find directly that the south end of his rows terminate at the fence, and the north ends at the second guide row just layed off, and unless his rows are on a level they will pour the water into this guide row, or by the side of the fence.

When he finishes this work he goes below the second guide row and lays off by that, and we go twenty steps below it, and lay off a third guide row. To do this we find two gullies to cross made on the side of a fence that has been removed.* They have a ridge betweeen them, on which the fence stood.

We call the hoe hands, not far off, shrubbing a ditch bank,† and send for a plowman with a turning plow, who is plowing in the first set of straight rows laid off by the eye; before he arrives the hoe hands have nearly filled the gully with shrubs, pieces of rails, turfs of grass, and the like substances, and have them ready for the dirt. The plowman goes up and down the ridges, and turns the dirt on and towards the gullies, and the hoes drag it on and fill up the gully with soil, trampling it down hard at the same time. This job done we dismiss them for the present.

Unless there is a good reason to commence laying off this third guide row at the fence, we commence it at the head, or beginning of the gullies, and lay off the row on one side, and then return to the starting place, and lay off on the other side of it.

To do this work well we first span the gullies and get the level to start with. We then lay off from the guide stake. We left the plowman on the lower side of the second guide row. When the plowman has laid off five or six rows by the second guide row he lays off his third guide row. As he crosses the gullies he turns up the rows a little, and crosses in a curve, or else after the dirt settles in the gully the water might accumulate in it and make a break. This row is examined for correction, and corrected. The plowman now lays off rows on the upper side of this guide row until his work meets. If there be any short rows they are between the two last guide rows.

We go below thirty paces, and lay off a fourth guide row. This will be sufficient for this hill-side. The plowman lays it off, plows a few rows above it, and then a few rows below the

* Gullies should not be allowed by the side of fences. The fences, if possible, should be placed on level land even if they are crooked. So should all plantation roads. All gullies should be stopped and filled up several days before the land is horizontalized in order that they may receive a rain or two to settle the dirt in them.

† Ditch banks and fence corners should be shrubbed, and all sprouts on the field grubbed up before the horizontaler goes to work, so that his work be not delayed.

third guide row, to throw the short rows between the two sets of rows. The balance of the rows are laid off by the last guide row. They get shorter and terminate between the angle of the ditches.*

SECTION XXV.

HORIZONTALING THIS HILL BY THE 2D LEVEL METHOD, WITH GUARD-DRAINS.

If we desired, we could make two guard-drains on this hill-side. One where the second guide-row is, at the brow of the hill, and the other where the fourth guide-row is, at the head of the gullies. We select these places, because the rows are more liable to break at the brow of the hill, and because the gullies have made breaks already. The first guard-drain would have less land to protect than the second, and its dimensions can be less than the second. We would make it ten inches deep, twelve inches wide, with a fall of one inch to the span of the level. The second drain would be twelve inches deep, and eighteen inches wide, and varying from one to three inches fall to the span of the level. To lay off the first one, we would commence at the south fence, at a certain place we desire to discharge the water. We might pass it under the fence into my neighbor's field, but as he has no corresponding drain, we let it go down the fence on our side.

We lay it off just as we do a circular row, except we give an inch fall, every span of the level, and turn up the end at the west fence to catch any water that might descend by the side of the fence.

To lay off the second drain, we commence at the head of the gullies, because if we commence at the fence, the drain might not pass them at that point, and to stop all breaks, gullies and washes, we must remove the cause first, and the cause is usually above the commencement, and sometimes some distance to one side of the break. It requires a skillful eye to detect it sometimes. We commence at the gullies and give two inches fall, and proceed to the south fence, and at the fence we give three inches the last span, to prevent the mouth of the drain from choking with trash and sand. We return to the gully, and run

* See Fig. 1. Peach Tree Hill. This hill was laid off by this method in 1851, and the gullies stopped in two years. As the rows next to the main ditch held water too long in the spring of the year, some of them have been altered so as to give a little fall to them, to empty the water at the fence, and then into the ditch. The hill-side was plowed as deep as one good mule could do it, and it has improved and produces much better than it did the first year with the same management.

the other way to the west fence, and the first span we give one and a half inches fall towards the south fence, then one inch the next span, and continue that fall to the end, and turn it up two inches at the fence. We have a drain row with a fall of from one inch at the west fence to two, and lastly, three inches fall at the other end. The gully by the fence takes the water into the ditch below.

The drains having been laid off and staked, so as to know them, we lay the rows off on a level as above stated for No. 1. Should they break, the guard-drains will arrest the water, and remove it when desired. This will suffice to explain this method.

SECTION XXVI.

HORIZONTALING THIS HILL BY THE GRADING METHOD.—No. 1.

Suppose we desire to lay off this hill with a fall to the rows, without the aid of drains or hill-side ditches, we would commence as we did for the level method, and lay off the top of the hill on a level, as we find it inconvenient to discharge the water up there. Then we would lay off the first guide row at the brow of the hill as was done for the level method, but give a fall of one inch to the span of the level towards the south fence. We would lay off a second guide row, where the third guide row is for the level method, at the head of the gullies, and give the same fall as the one above. One more guide row would be sufficient. In plowing out the rows, the plowman lays off a few rows below the first and then a few above the second guide rows, so that the short rows may be midway between them, if any. Now, if the short rows were to empty the water into any one of the long rows, it would cause that row to wash into a gully. So we plow them on a level. The same disaster would happen if the short rows were to terminate with a fall with a guide row. To avoid that mischief, we lay off long rows by the guide rows, so as to throw the short rows between the long rows as above mentioned.

The balance of the land can be plowed by the third guide row. But we find that they will terminate at the ditch, and there is no provision made for the exit of the water. We have either to lay off a drain by the side of the ditch, or lay off two rows next to the ditch and parallel to it, and make a drain of the water furrow of the second row next to the field. This is the best plan if the land adjoining the ditch is higher than the adjoining land. The graded rows then empty into that furrow, and it is

conveyed to the gully by the side of the fence, and from thence into the main ditch.

But should the drain by the side of the ditch have too much fall to admit of the above plan, we should have to adopt some other plan to receive the water and to discharge it into the ditch. We should have to plow all the rows in the angle of the ditches on a level, or cut a guard-drain from the point of intersection of the ditch and south fence, to the north ditch, and give two inches fall to it, and empty the rows in the angle of the ditches into it.

SECTION XXVII.

HORIZONTALING THIS HILL BY THE 2D GRADING METHOD.

We have to lay off the drains, and then the rows with the same fall as that of the drains. Two drains in the same places as those for the level culture would answer. We would discharge the water at the same fence, and with a grade from one to two inches fall and twelve inches deep and fifteen inches wide. The rows are laid off by the drains as above stated. The first rows above and below the drains should be five feet distant to give room for the channel and bank of the drains. All short rows should be between the long ones, and plowed on a level. If they terminated into a long one they would wash it, and if they terminated in the drain below they would fill it up with sand.

SECTION XXVIII.

HORIZONTALING THIS HILL BY THE 3D GRADING METHOD.

The rows by this method must discharge the water into the ditches We cannot explain it so well here, unless we suppose the main ditches and the gully by the side of the fence to act as substitutes for the hill-side ditches. The drains are laid off as by the preceding method, but with more fall, to convey the water off more speedily. We then run the rows with a fall of one and a half inches into the ditches. Many of them will terminate at the ditches and many elsewhere. The liability to wash the land, and the trouble of discharging the water, would make it objectionable on this hill-side, but the method might answer a better purpose on other places.

SECTION XXIX.

HORIZONTALING THIS HILL BY THE 4TH METHOD.

The straight row method could be applied here; and with the protection of hill-side ditches with three inches fall to them, the land would not sustain as much damage as it has done by the same method without the ditches. For hill-side ditches would do for this hill-side, with a fall of from three to five inches, eighteen inches deep, and twenty-four wide. They must be capacious, to receive and retain the sand and water. After they are laid off and staked, the plowman sets his stakes, and plows up and down hill. In cultivating, the plowman has to raise his plow over the banks of the ditches as he passes them. This is troublesome, and he is likely to plow down the banks. This method would do much mischief to this hill in a few years, and cause much labor to keep the drains clear, and the banks up. It would be very objectionable to this kind of land.

SECTION XXX.

LAYING OFF GUARD-DRAINS AND HILL-SIDE DITCHES WITH THE RAFTER LEVEL.

A skillful horizontaler can lay off these drains very well, with an engineer's, and other levels of simple construction, but, as we write more especially for the instruction of new beginners of the art, we shall use the rafter level. We will select the Triangular Ridge, in the same field for operations. It lies north and south, near two hundred yards long, the apex of the triangle being east, and the base west, about one hundred and fifty yards wide. The ridge inclines south, east and west, and the water naturally flows south, south-east, and south-west. It is bounded on the east by a fence, on the west by a ditch, on the north by a ditch, and on the south by a flat and drain.

We take the level and go on the ridge where the greatest slope south begins, and the greatest expansion east and west takes place, more properly, where the ridge begins to break up, and spread out into the flat, south, west, and east. We set the level across the backbone of the ridge, and find the exact level, and stick a stake down by the side of the plumb line, called the medium stake. We now go east and place the hind foot by the side of the stake, and move the forefoot until the plumb-line settles at the half inch mark of fall on the graduated bar; we then move the level, and put the hindfoot exactly where the

forefoot stood, and move the forefoot until the plumb-line settles at three-quarters of an inch fall on the bar; we move it again, and repeat the same movements until we get to two and a half inches fall, and continue that fall to the last span of the level, and give it three inches fall; we finally turn down the level to the corner of the fence to six inches fall, so as to give the drain a sufficient curve to catch the water descending in a gully by the side of the fence, and convey it out without breaking the bank of the ditch. We return then to the medium stake, and proceed exactly in the same way for this part of the drain, as we did for the preceding part, until we get to the wet flat bordering the ditch, and from thence to the ditch we give three inches fall, and turn down the line, so that it may enter the ditch at an acute angle, to keep it from being choked at its mouth.

In laying off this line, we stick a long cane every sixth, and a short one at every third, span of the level. We now lay down the level and examine the line. We find the stakes standing irregularly, some out and some inside of the line, rather zigzag. We re-set them by the eye, and order the plowman to follow us with the scooter plow. We walk from stake to stake and just ahead of the mule, (who will soon learn to follow,) and leave them for him to knock down and the little boy to pick up. When we reach the end, at the ditch or fence, the plowman waits until we examine, with the level, his furrow, to see if it is correct; if there be any deviations from a correct and regular fall, we mark the places and direct the plowman to run them over. When it is done right, he takes the hill-side plow and retraces the line, throwing the furrow down hill, and thus continues throwing two or three more furrows in the same manner, and the hoe-hands drag out the dirt and form an embankment, making it higher at the fence and ditch, as the danger of its breaking is at those places. The plowman runs two or more furrows in the drain from each end up to the one-inch grade, and stops at that point, as it is deep enough there. When the ditch is finished, it will vary in depth from the medium stake to the ditch and to the fence, from six to eighteen inches deep, and from eighteen to twenty-four inches wide.*

As the wet flat, bordering the ditch the whole length of the ridge, needs draining, and as the land has been cross-plowed, and cut into ruts by the plow and water, we conclude to

* See Fig. 1, H. S. D. Triangular Ridge.

SECTION XXXI.

HORIZONTAL IT WITH THE GRADING METHOD, NO. 3,

With a fall to the rows of one inch to the dry land and three inches to the flat.

We will commence and lay off a guide row where the wet and dry land joins at the hill-side ditch, and run north to the main ditch. This row is nearly straight. The plowman lays off all the rows by it to the main ditch in the wet land, with the same fall, four feet apart. We go to the medium stake, and lay off a row north, on the backbone of the ridge, and find it varies but little from a straight line, and terminates at the north angle of the ridge at the ditch, and give it a fall from that point to the hill-side ditch of one inch to the span of the level. The plowman now lays off the rows on each side of this row by it, to the first guide row to the fence. We see that it is done correctly, and put in a short row occasionally, to keep the correct and regular grade. In cultivating this ridge, we have had to make a few water furrows across the rows on the wet flat with the plow, to drain it quicker during heavy showers. This is all the trouble we have had with this ridge since it was horizontalized.

SECTION XXXII.

GUARD-DRAINS.

Below this hill-side ditch we have made four guard-drains, two on the east side of the ridge, and one on the west, the first one about fifty yards from the ditch, and the second one thirty yards below that one, both nearly parallel to the ditch. The first one about half the length of the ditch, and the second one not quite so long as the first; both have a grade of from one to three inches, twelve inches deep at the outlet, and six inches deep at the heads and fourteen inches wide.*

The one on the west side of the ridge is straight and the lower end of it is a double drain, receiving and discharging the water on both sides of it into the main ditch.†

The two first are laid off in the same manner commencing at the fence and proceeding up into the field.

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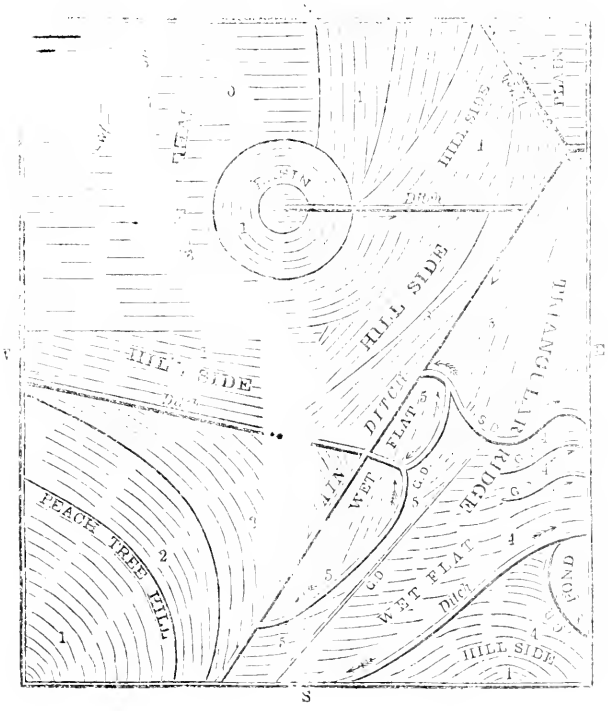
* See G. D., a a, fig 1.
† See G. D., b, fig 1.

The fourth drain we commence at the hill-side ditch, into which the drain discharges at the north end, and curves up and down, and then up and down again, to the main ditch south, and just before it reaches the main ditch it divides into two, separated merely by the bank. The middle of the E connects with a drain that leads to the ditch, making three outlets for this drain, one into the hill-side ditch, and two into the main ditch.

We need not describe the laying off and constructing of these guard-drains, as it is the same as for the hill-side ditches.

We might write many more pages on this subject, to illustrate the minutiæ of this beautiful art, but as the *Essay* is already much longer than we desire, we refrain, but will illustrate it by a couple of *figures* for the examination and study of those who take sufficient interest in the art, and hope to make it sufficiently intelligible for the understanding of our readers.

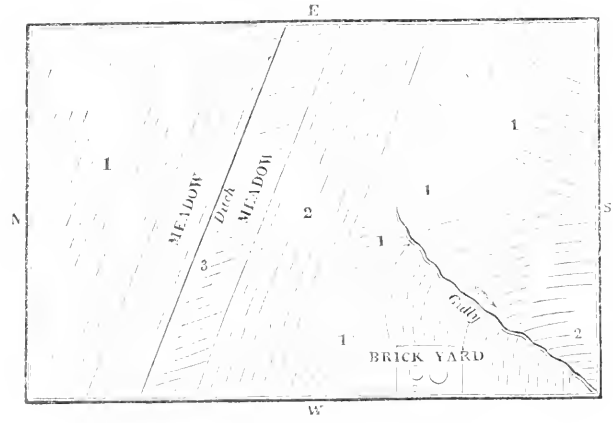
FIG. 1.—GIN-HOUSE FIELD, 45 ACRES.



EXPLANATION OF THE FIGURE.

0. Straight rows by the eye.
1. Level Method, - - - - No. 1.
2. " " - - - - - " 2.
3. Grading Method, - - - - " 1.
4. " " - - - - - " 2.
5. " " - - - - - " 3.
" " - - - - - " 4. Not illustrated.

Fig. 2.—BRICK-YARD FIELD, 10 ACRES.



EXPLANATION OF THE FIGURE.

1.	Level Method,	No. 1.
2.	Grading Method,	" 1.
3.	" "	" 3.

The gully was stopped in two years.

Note.—Since the foregoing was published, I have seen the following, which settles the introduction of the horizontal culture in the United States on Mr. Jefferson:

"The practice of horizontal cultivation, or 'circling' the rows, so as to keep them on a level on hilly and rolling land, was introduced by the late Mr. William Dunbar, of the Forest, in Adams County, Mississippi, (as Mr. Dunbar is known to have stated in conversation in the town of Washington, in 1810,) at the suggestion of Mr. Jefferson, of whom Mr. Dunbar was a correspondent for many years, when the former was President of the United States. Having observed when in France, this economical manner of cultivating the mountain sides, Mr. Jefferson recommended it as well adapted to our broken lands. The practice was tardily adopted, and, like all similar innovations on established usages, met at first with its share of ridicule."—*From Waile's Report on the Geology and Agriculture of Mississippi.*

(See the reference in the "History of Horizontal Culture," page 9.)

N. T. S.

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